

Department of Computer Sc & Engg, IIT Kharagpur
Fault Tolerant Systems (CS60058)
Mid-Semester Examination, February 2013
Answer ALL Questions, Time 2 hrs, Full Marks: 60

- 1.
- a. What are the Interactive Consistency (IC) conditions for handling Byzantine Failure?
 - b. Present an algorithm for reaching an agreement on the value in the presence of Byzantine Failures.
 - c. Show the working of the algorithm for $N=7$ and $m = 2$, where the source and one other unit are faulty.
 - d. Prove that we can satisfy the IC conditions by the algorithm if $N \geq 3m + 1$ where N is the number of nodes and m is the maximum number of faulty nodes.

[3+5+5+5=18 marks]

2. Present the encoding and decoding circuits for the (15, 11) cyclic code with generating polynomial $X^2 + X + 1$.

[8 marks]

- 3.
- a. What are the properties of ensuring quorum in vote assignment based data replication? Prove that under such conditions a quorum is guaranteed.
 - b. Present an algorithm for dynamic vote assignment in the case when a portion of the system becomes disconnected. Show its working on an example.
 - c. What protocols must be followed to allow nodes to rejoin the system after repair?

[4 +7+4 = 15 marks]

- 4.
- a. Explain the working of an $N \times N$ cross-bar network and analyze its fault tolerance capabilities.
 - b. How is this $N \times N$ cross-bar network made fault tolerant? How would you evaluate its fault tolerance?
 - c. How does the cross-bar network compare with the butterfly network for the same number of inputs and outputs in terms of reliability and component complexity?
 - d. Draw a 4-dimension cube-connected cycle network. What is the diameter of a k -dimension cube-connected cycle? Give a proof of your answer.

[5+5+4+5=19 marks]